

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

Claims 1-14(Canceled).

Claim 15(Original). An apparatus for sustainable CO<sub>2</sub>-free production of hydrogen and carbon via continuous thermocatalytic decomposition of hydrocarbons over carbon-based catalyst in air and/or water-free environment, employing continuous reactivation of the catalyst, comprising the combination of:

- (a) a thermocatalytic reactor with a stream having a moving bed of carbon particulates;
- (b) means for recovering hydrogen-containing gas from said reactor;
- (c) means for recovering pure hydrogen from said stream;
- (d) means for recycling at least a portion of hydrogen-depleted gas to said reactor;
- (e) means for disintegration of carbon particles after said reactor; and
- (f) means for heating of carbon particles

Claim 16(Original). The apparatus of claim 15, where the moving bed reactor is a fluidized bed reactor.

Claim 17(Original). The apparatus of claim 15, where the carbon-based catalyst is carbon black.

Claim 18(Original). The apparatus of claim 15, where the means of recovering pure hydrogen is a membrane gas separation unit.

Claim 19(Original). The apparatus of claim 15, where the means of disintegration is a grinder.

Claim 20(Canceled).

Claim 21(Original). An apparatus for generating electricity and producing carbon, comprising the combination of:

- (a) a thermocatalytic reactor with a moving bed of carbon particulates;
- (b) means for recovering hydrogen-containing gas from said reactor;
- (c) means for recycling at least a portion of hydrogen-depleted gas to said reactor;
- (d) means for disintegration of the carbon particulates after said reactor;
- (e) means for heating of carbon particles;
- (f) means for recovering pure hydrogen from said stream; and
- (g) means for transporting said pure hydrogen into anode of a fuel cell, whereby electricity is generated.

Claim 22(Original). The apparatus of claim 21, where the moving bed reactor is a fluidized bed reactor.

Claim 23(Original). The apparatus of claim 21, where the carbon particulate is carbon black.

Claim 24(Original). The apparatus of claim 21, where the means of recovering pure hydrogen is a membrane gas separation unit.

Claim 25(Original). The apparatus of claim 21, where the means of disintegration is a grinder.

Claim 26(Original). The apparatus of claim 21, where the means of transporting and generating electricity is a polymer electrolyte membrane fuel cell.